U.S. Department of Transportation
Federal Aviation Administration

Memorandum

Subject: INFORMATION: Equivalent Level of Safety Finding (ELOS) for Bombardier Aerospace Model CL-600-2B19, Series 100, TD3995NY-T

Date:

Reg Ref § 25.621(c)(2)

From: Manager, Transport Airplane Directorate, Airframe/Cabin Safety, ANM-115

Reply to Attn. of: Serge Napoleon ANE-171

To: Manager, New York ACO

ELOS Memo # TD3995NY-T-A-1

The purpose of this memorandum is to inform the certificate management certification office of an evaluation made by the Transport Airplane Directorate on the establishment of an equivalent level of safety finding for the Bombardier Aerospace Model CL-600-2B19, Series 100.

Background

Bombardier Aerospace (BA) intends to introduce a new design change into their production standard aircraft that will become part of the type design for the CRJ CL-600-2B19 series 100 aircraft model. That design consists of a new over-wing emergency exit door. The new door is to be manufactured as a single casting. The casting includes the inner and outer formers with the integral stop fittings. The supplier of the casting for the door is GSC located in Ogden, Utah.

GSC is the latest foundry retained by Bombardier as supplier of the casting door. Bombardier Aerospace states that it had made arrangement in 1998 with another supplier source, Cercast, located in Montreal, to produce the CRJ overwing emergency cast substructure. Bombardier contends that, prior to the cancellation of the program with Cercast, the full-scale static test and the full scale DADT test for that redesigned casting door were completed. It also contends that Transport Canada made an equivalent safety finding for the Cercast door, whose basis was to monitor the mechanical properties for each casting.

Bombardier Aerospace has indicated that, for its type design change of the Bombardier CL-600-2B19 (Regional Jet Series 100) redesigned over-wing cast door, it does not intend to demonstrate compliance with an applicable airworthiness requirement [§25.621(c)(2)]. Bombardier states that the Cercast cast door, which received TCCA approval but not FAA, is based on a casting factor of 1.25 and also on a single static test.

Applicable Regulations

§25.621(c)(2)

Regulation(s) Requiring an ELOS

§25.621(c)(2)

Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations, or equipment needed for equivalency)

Bombardier Aerospace intends to provide an equivalent level of safety to the requirement of FAR § 25.621(c)(2), by ensuring consistent material properties of the casting produced, and also by confirming the design allowables of the casting. This is to be achieved through:

- Monitoring of the material properties of the casting through testing.
- Monitoring of the cast door in production to ensure that it consistently conforms to the type design.
- Continuous monitoring of the cast door material properties through a cut-up inspection and testing of the produced cast door at some specific interval.

As to the change of foundry, Bombardier will have criteria in place to assure that such a change will have no effect on the test data, the material properties, and the cast door produced.

- The Bombardier's specification for the subject casting has requirements defined to address change of foundry.

- Bombardier will have procedures in place to maintain the equipment and tooling specifications in addition to the process.

- Bombardier will maintain process control of the cast door, and will continue to monitor such process. Bombardier, as was used with Cercast, will subject GCS and any subsequent foundry retained by Bombardier, to the same approval process.

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

The Cercast door in production was to be subjected to a proving and monitoring program. The proving aspect of the monitoring program consisted of geometry check of the first door produced, carrying out full-scale static test and full-scale DADT test using the next two doors produced, and performing cut-up mechanical property testing to confirm the design allowables used. Subsequently the rest of the monitoring program would consist of testing the integral attached specimens of every cast door to assess their mechanical properties.

The casting process of the Cercast produced door was to be subjected to an ongoing monitoring program through which each casting will be subjected to both radiographic and liquid penetrant

inspections, in addition to the aforementioned mechanical property testing. Also every twenty-fifth door produced was to be subjected to the cut-up inspection and testing procedure for verification of the material properties of the cast door.

GSC and CERCAST may or may not have the same identical casting process, as each foundry process is proprietary. However, both GSC and CERCAST processes are subject to identical process control as set forth in Bombardier specification, MPS 171-8. Also, BA has qualified both companies and their processes for the cast door application. The above-mentioned MPS addresses the qualification and control process required of foundry making castings for Bombardier and covers the scenario of changing foundry. Likewise, the same MPS applies to having procedures in place to maintain the equipment and tooling specifications. The CERCAST as well as GSC Cast doors are controlled by this MPS.

BA will subject GSC to the same material and supplier approval process as was used with Cercast. Coupon tests of excised and integral components of the GSC door will show that the mechanical properties of the GSC cast door meet the same minimum values established in the SAE specification AMS 4249. Such results will be used in the static and DADT analyses. If the results of the coupon tests show that the GSC cast door material properties are less than those of the Cercast produced door, then BA will demonstrate that the over-testing carried out during the Cercast door test program will adequately cover the lower values of the GSC door. BA will show that the casting factor for the GSC cast door will at no time be less than 1.25.

As such Bombardier will have provisions in place to eliminate or minimize at the very least the probability of structural failures due to material variability that is associated with castings, and also ensuring consistent material properties.

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding addressed in issue paper A-1. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Airplane Directorate has assigned a unique ELOS Memorandum number to facilitate archiving and retrieval of this ELOS. This number should be listed in the Type Certificate Data Sheet in the Certification Basis section as a statement for a TC or ATC project or on page 3 of the STC for an STC project. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):
§ 25. 621(c)(2) Critical Castings (documented in TAD ELOS Memo TD3995NY-T-A-1)

/s/ Jeff Gardlin	8/8/03
Manager, Transport Airplane Directorate, Airframe/Cabin Safety, ANM-115	Date

ELOS Originated by New York ACO:	Project Engineer: Serge Napoleon	Routing Symbol ANE-171